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Claims

1.   Apparatus for oscillating a windshield wiper device having a wiper, comprising:

fig 3, 5 a) a motor for driving the windshield wiper device;

18 b) a first detector including a detectant which rotates in synchronism with the wiper, the detector physically identifying a plurality of distinct angular zones for the wiper, including a wiping zone and a wiper out-of-bound ("OOB") zone;

17 c) a second detector for detecting incremental movement of the wiper within any given zone; and

20 d) control circuitry for reversing the direction of motion of the motor based on the incremental motion of the wiper in the wiping zone and for reversing the motor or generating an error signal in the event the first detector detects the out-of-bound zone.

2.   Apparatus according to claim 1, wherein at least one of the zones represents permissible wiper park positions ("park zone"), the park zone being intermediate of the wipe zone and the OOB zone.

3.   Apparatus for oscillating a windshield wiper device having a wiper, comprising:

a) a motor for driving the windshield wiper device;

b) a first detector including a detectant which rotates in synchronism with the wiper, the detector physically identifying a plurality of distinct angular zones across the entire range of motion of the wiper, said zones including a wiper park zone, a wiping zone, and a wiper out-of-bound ("OOB") zone;

c) a second detector for detecting incremental movement of the wiper within any given zone; and

d) control circuitry for controlling the direction of motion of the motor based on the detected zone and the incremental motion of the wiper therein;

e) whereby, upon power-up, the control circuitry can immediately determine the wiper zone.

4. Apparatus for oscillating a windshield wiper device having a wiper, comprising:

a) a motor for driving the windshield wiper device;

b) a first detector including a detectant which rotates in synchronism with the wiper, the detector physically identifying at least four distinct angular zones for the wiper, including a wiper park zone, a wiper turning point zone, a wiping zone, and a wiper out-of-bound ("OOB") zone;

c) a second detector for detecting incremental movement of the wiper within any given zone; and

d) control circuitry for reversing the direction of motion of the motor based on the incremental motion of the wiper in the wiper turning point zone and the wiping zone;

e) whereby, upon power-up, the control circuitry can immediately determine if the wiper is in the park zone, the wipe zone or the OOB zone.

5. Apparatus for oscillating a windshield wiper device having a wiper, comprising:

a) a motor for driving the windshield wiper device;

b) a first detector, including a detectant which provides at least four detectable binary state sectors along a path and two readers situated along the path that are spaced apart a distance less than the length of the shortest sector along the path, wherein the detectant rotates in synchronism with the wiper and the readers are fixed in position.

c) a second detector for independently detecting incremental movement of the wiper in any direction; and

d) control circuitry for reversing the direction of motion of the motor based on the incremental motion of the wiper in two selected adjacent sectors.

6.   Apparatus according to claim 5, wherein the path is circular.

7.   Apparatus according to claim 5, wherein the sectors are alternating arrangements of: magnetic pole polarities; conductive and nonconductive surfaces; or reflective and non-reflective surfaces.

8.   A control system for a wiper driven by a reversible electric motor, comprising:

a) a pulse width modulation (PWM) signal generator for driving a motor bridge circuit;

b) a first control loop providing a first output based on a difference between a measured wiper position and a desired wiper position;

c) a second control loop providing a second output based on a difference between a measured current flowing through the motor and zero;

d) a summer for subtracting the second output from the first output and providing the result to the PWM signal generator; and

e) a comparator for generating a signal which suppresses the duty cycle provided by the PWM signal generator in the event the measured current exceeds a threshold current.